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METHOD FOR MANUFACTURING ANTIBACTERIAL FILTER MATERIAL

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[There are no amendments to this patent.]

Abstract

Constitution

A method for manufacturing an antibacterial filter material characterized by the fact that it dips a filter material into a treating liquid, which is constituted by dispersing an antibacterial component composed of zinc oxide with a particle diameter of 0.05 μm or less into an aqueous solution of an aqueous emulsion resin, and fixes the antibacterial component on the surface of the filter material by drying.

Effect

An antibacterial filter material with antibacterial performance superior to that of conventional materials can be obtained by manufacturing the filter material of the present invention. Also, the antibacterial filter material has antibacterial property even after washing with water in addition to the antibacterial property during general filtration, can be reused in terms of application such as air filter utilization, and is also economically excellent.

Claims

1. A method for manufacturing an antibacterial filter material characterized by the fact that it dips a filter material into a treating liquid, which is constituted by dispersing an antibacterial component composed of zinc oxide with a particle diameter of 0.05 μm or less into an aqueous solution of an aqueous emulsion resin, and fixes the antibacterial component on the surface of the filter material by drying.

2. The method for manufacturing an antibacterial filter material of Claim 1 characterized by the fact that as the antibacterial component, in addition to zinc oxide, zinc pyrithione and/or zinc undecylenate with a particle diameter of 1 μm or less are used.

Detailed explanation of the invention

[0001]

Industrial application field

The present invention pertains to a method for manufacturing a filter material for retaining a long-term antibacterial effect, that is, a method for manufacturing an antibacterial filter material used in air filters, such as for air conditioners, made of synthetic fiber, fabric, nonwoven fabric, synthetic resin molded product, etc.

[0002]

Prior art

As a conventional filter material for imparting an antibacterial property, for example, a filter material in which an organic sterilizer such as chlorohexidine group, organosilicon quaternary ammonium group, and quaternary ammonium group is spread on the surface, a filter material in which metallic copper is woven in the fibers, a filter material on which metallic silver is vapor-deposited, a filter material in which an inorganic group sterilizer such as zeolite containing silver and copper ions and apatite powder is mixed, etc., are mentioned.

[0003]

Problem to be solved by the invention

However, in the conventional filter materials, for example, the filter material on which an organic sterilizer was spread, the retention of the antibacterial activity was deficient, and in the filter material in which copper or silver fibers were kneaded, since the metal exhibiting the antibacterial property was difficult to ionize, the effect was very small and could be used only for specific uses. The objective of the present invention is to solve the problems of the above-mentioned prior art. In other words, its objective is to provide a method for manufacturing a filter material which retains a long-term antibacterial property, offers excellent workability and storage stability, does not harm the human body, and also has excellent protection against harming the environment.

[0004]

Means to solve the problem

These inventors conducted earnest research, and as a result, it was discovered that the conventional problems could be solved by fixing a zinc pyrithione and/or a zinc undecylenate with a specific particle diameter as an antibacterial component as needed on the surface of the filter material. Then, the present invention was completed. In other words, the present invention a method for manufacturing an antibacterial filter material is characterized by the fact that it dips a filter material into a

treating liquid, which is constituted by dispersing an antibacterial component composed of zinc oxide with a particle diameter of 0.05 μm or less into an aqueous solution of an aqueous emulsion resin, and fixes the antibacterial component on the surface of the filter material by drying. The zinc oxide of the inorganic group sterilizer as an antibacterial component used in the present invention must have a particle diameter of 0.05 μm or less. If the particle diameter is more than 0.05 μm, the antibacterial activity is markedly lowered. In the present invention, in addition to the zinc oxide, if necessary, zinc pyrithione and/or zinc undecylenate may also be added as the antibacterial component. The particle diameter of the zinc pyrithione and/or zinc undecylenate is preferably 1 μm or less. If the particle diameter is more than 1 μm, penetration into the filter material deteriorates, and the cleaning resistance is lowered. Also, in the present invention, in addition to the above-mentioned antibacterial component, a mineral micropowder such as titanium oxide may be mixed as a component for increasing the amount for dispersion, and when a fungicide is required, a fungicide component such as thiapentazole may be added.

[0005]

As the aqueous emulsion resin being used in the present invention, there is no special limitation. However, in case a filter base material made of glass fibers or polyester resin is used, preferably, a polyethylene terephthalate resin is used for the core, terminated by an isophthalosulfonic acid or sodium isophthalic sulfonate. Similarly, a water-soluble polyester resin with an average molecular weight of 10,000-20,000, terminated by

a parastyrenesulfonic acid or sodium parastyrene sulfonate is preferable. Also, when a filter base material made of a polypropylene resin or vinyl chloride resin is used, an aqueous emulsion resin having polypropylene as a core and terminated by chlorosulfinic acid or sodium chlorosulfonate is preferable.

[0006]

The treating liquid of the present invention is prepared by dispersing an antibacterial component into water using a sand mill, etc., adding an aqueous emulsion resin, adding an anionic or nonionic surfactant as a dispersant as needed, and uniformly dispersing it. The content of the antibacterial component and the aqueous emulsion resin in the treating liquid of the present invention is not specially limited. However, preferably, the zinc oxide is 0.01-10 wt%, the zinc pyrithione and/or zinc undecylenate is 0.005-5 wt%, or the aqueous emulsion resin (solid) fraction is 10 wt%. The antibacterial filter material of the present invention is manufactured by dipping a filter material into the above-mentioned treating liquid of the present invention and fixing an antibacterial component on the surface of the filter material by drying.

[0007]

Application examples

Application Example 1

20 g zinc oxide micropowder (purity: 99.9%, average particle diameter: 0.020 μm) were dispersed for 45 min into 78 g aqueous solution, to which 1 g each of anionic dispersant, octylphenol, and ethylene oxide benzyl ether was added, using a sand mill, and 20 parts said solution were added to 80 parts water-soluble polyester resin (Baironal[transliteration] MD-1200 made by Toyobo Co., Ltd.) and dispersed for 20 min the sand mill, so that a treating liquid of the present invention was formed. The filter base material made of glass fibers was dipped into the treating liquid, squeezed with a mangle to reduce the area 75%, and dried at 160°C for 20 min, so that an antibacterial filter material (A-1) of the present invention was obtained. The antibacterial filter material (A-1) of the present invention, a comparative filter material (H-1), in which the zinc micropowder was replaced with zinc oxide (purity: 99.9%, average particle diameter: 1 μm) and similarly treated, and an untreated glass fiber filter material (C-1) were tested by a method for measuring the number of bacteria (Fiber Product Hygiene Processing Association). As a result, as shown in Table I, the filter material of the present invention exhibited an excellent antibacterial property. The comparative filter material seldom exhibited the effect.

[0008]

Table I

Application Example 1: Results

① 濾過材		② 生菌数値	③ 増減値	④ 増減値差
	⑤ 植菌数	4×10^{8} log 5.6	*	*
C－1	⑥ 無加工	2×10^{8} log 8.3	2．7	*
A－1	⑦ 実施例	2×10^{8} log 3.3	－2．3	5．0
H－1	⑧ 比較例	2×10^{8} log 8.3	2．7	0

Key: 1 Filter material
2 Number of live bacteria
3 Increased and decreased value
4 Difference between the increase and decrease values
5 Number of bacteria inoculated
6 Untreated
7 Application example
8 Comparative example

[0009]

Application Example 2

20 g zinc oxide micropowder (purity: 99.9%, average particle diameter: 0.02 μm) and 2 g zinc pyrithione (average particle diameter of 0.7 μm) were dispersed for 30 min into 75.50 g of an aqueous solution, to which 2 g nonionic surfactant (Primal 850 made by Rohm & Haas Co.) and 0.5 g polyethylene glycol nonylphenyl ether were added, by a sand mill, and 20 parts said solution (B-1 solution) were added to 80 parts water-soluble polyester resin (PE-20 made by Futaba Fine Chemical K.K.) and dispersed for 20 min the sand mill, so that a treating liquid of the present invention was formed. The filter base material made of glass fibers was dipped into the treating liquid, squeezed with a mangle to reduce area 70%, dried at 100°C for 20 min, and cured at 160°C for 1 min, so that an antibacterial filter material (A-2) of the present invention was obtained. The antibacterial filter material (A-2) of the present invention, a comparative filter material (H-2), in which 20 parts B-1 solution were added to 80 parts water and similarly dispersed for 20 min using the sand mill, and an untreated glass fiber filter material

(C-1) were repeatedly cleaned 30 times by method 103 of JIS L 0217. These analytes were tested by the method for measuring the number of bacteria (Fiber Product Hygiene Processing Association). As a result, as shown in Table II, the filter material of the present invention exhibited an excellent antibacterial property. The comparative filter material seldom exhibited the effect.

[0010]

Table II

Application Example 2: Results

①濾過材		②生菌数値	③増減値	④増減値差
	⑤植菌数	4×10^{5} log 5.6	*	*
C－1	⑥無加工	2×10^{8} log 8.3	2．7	*
A－2	⑦実施例	7×10^{3} log 3.8	－1．8	4．5
H－2	⑧比較例	1×10^{7} log 7.0	1．4	1．3

Key: 1 Filter material
2 Number of live bacteria
3 Increased and decreased value
4 Difference between the increase and decrease values
5 Number of bacteria inoculated
6 Untreated
7 Application example
8 Comparative example

[0011]

Application Example 3

15 g zinc oxide micropowder (purity: 99.9%, average particle diameter: 0.020 μm), 5 g zinc titanium micropowder (average particle diameter: 0.050 μm), and 3 g zinc undecylenate (average particle diameter: 0.8 μm) were dispersed for 30 min into 74.50 g aqueous solution, to which 2 g anionic surfactant (Primal 850 made by Rohm & Haas Co.) and 0.5 g polyethylene glycol nonylphenyl ether were added, by a sand mill, and 20 parts said solution (B-2 solution) were added to 80 parts water-soluble polyester resin (PE-20 made by Futaba Fine Chemical K.K.) and dispersed for 20 min by the sand mill, so that a treating liquid of the present invention was formed. The filter base material made of glass fibers was dipped into the treating liquid, squeezed at a reduction rate of area of 70% by a mangle, dried at 100°C for 20 min, and cured at 150°C for 2 min, so that an antibacterial filter material (A-3) of the present invention was obtained. The antibacterial filter material (A-3) of the present invention, a comparative filter material (H-2), in which 20 parts B-2 solution was added to 80 parts water and similarly dispersed

for 20 min by the sand mill, and an untreated glass fiber filter material (C-1) were repeatedly cleaned 30 times by 103 method of JIS L 0217. These analytes were tested by the method for measuring the number of bacteria (Fiber Product Hygiene Processing Association). As a result, as shown in Table III, the filter material of the present invention exhibited an excellent antibacterial property. The comparative filter material seldom exhibited the effect.

[0012]

Table III

Application Example 3: Results

① 濾過材		② 生菌数値	③ 増減値	④ 増減値差
	⑤ 植菌数	6×10^{8} log 5.8	*	*
C－1	⑥ 無加工	1×10^{8} log 8.0	2．2	*
A－3	⑦ 実施例	1×10^{4} log 4.0	－1．8	4．0
H－2	⑧ 比較例	1×10^{7} log 7.0	1．2	1．0

Key: 1 Filter material
2 Number of live bacteria
3 Increased and decreased value

4 Difference between the increase and decrease values
5 Number of planted bacteria
6 Untreated
7 Application example
8 Comparative example

[0011]

Application Example 4

20 g zinc oxide micropowder (purity: 99.9%, average particle diameter: 0.020 μm) and 2 g zinc pyrithione were dispersed for 30 min into 75.50 g of an aqueous solution, to which 2 g nonionic surfactant (Primal 850 made by Rohm & Haas Co.) and 0.5 g polyethylene glycol nonylphenyl ether were added, using a sand mill, and 20 parts said solution (B-3 solution) were added to 80 parts 30% propylene chlorosulfonated propylene resin (Hardren[transliteration] E-10 made by Toyo Kasei K.K.) and dispersed for 20 min using the sand mill, so that a treating liquid of the present invention was formed. The filter base material made of glass fibers was dipped into the treating liquid, squeezed with a mangle to reduce the area 70%, dried at 100°C for 15 min, and cured at 110°C for 1 min, so that an antibacterial filter material (A-4) of the present invention was obtained. The antibacterial filter material (A-4) of the present invention, a comparative filter material (H-2), in which 20 parts B-3 solution were added to 80 parts water and similarly dispersed for 20 min using the sand mill, and an untreated glass fiber filter material (C-1) were repeatedly cleaned 30 times by method 103 of JIS L 0217. These analytes were tested by the method for measuring the number of bacteria (Fiber Product Hygiene

Processing Association). As a result, as shown in Table IV, the filter material of the present invention exhibited an excellent antibacterial property. The comparative filter material seldom exhibited the effect.

[0014]

Table IV

Application Example 4: Results

①濾過材		②生菌数値	③増減値	④増減値差
	⑤植菌数	8×10^{5} log 5.9	*	*
C－1	⑩無加工	2×10^{8} log 8.3	2．4	*
A－4	⑦実施例	7×10^{2} log 2.8	－3．1	5．5
H－2	④比較例	2×10^{7} log 7.3	1．4	1．0

Key: 1 Filter material
2 Number of live bacteria
3 Increased and decreased value
4 Difference between the increase and decrease values
5 Number of bacteria inoculated
6 Untreated
7 Application example
8 Comparative example

[0015]

Effect of the invention

An antibacterial filter material with antibacterial performance superior to that of conventional materials can be obtained by manufacturing the filter material of the present invention. Also, the antibacterial filter material has antibacterial property even after washing with water in addition to the antibacterial property during general filtration, can be reused in terms of application such as air filter utilization, and is also economically excellent.